

on, about three miles northeast of station. A thunder-storm, accompanied by small hail, prevailed at Salt Lake City during the afternoon. Considerable damage was done to crops in the surrounding country.

Fort Maginnis, Montana: a severe storm prevailed from 4.50 to 6 p. m. on the 26th, the wind reaching a maximum velocity of sixty-three miles per hour. Very heavy rain and some hail accompanied the storm.

Tallahassee, Florida: trees and fences were blown down and the cotton crop seriously injured by the rain and wind storm of the 30th.

The following are reports of tornadoes which occurred during August, 1885, forwarded by special tornado observers of the Signal Service, of whom there are more than 1,400.

3d.—A tornado occurred at Camden, New Jersey, and Philadelphia, Pennsylvania, at 3.20 p. m. It pursued a north-northeasterly course for a distance of eight miles, its path being of an average width of 1,200 feet. The shortest time in passing a given point was thirty seconds, and its progressive movement is estimated at fifty miles per hour. Five hundred buildings were either destroyed or injured, and two steamers were wrecked; six persons were killed and nearly one hundred injured. The damage is estimated at \$500,000. (See report of Signal Service observer at Philadelphia concerning this storm.)

3d.—At 4 p. m. a tornado started at a point one mile above Feasterville, Bucks county, Pennsylvania, and passed through Churchville and Richborough, ending at Pineville, a distance of eleven miles from where it first started. Its course was to the northward, and in its path five dwellings, seven barns, and many other out-buildings were destroyed. The shortest time in passing a given point was two minutes.

3d.—At 2.30 p. m. a tornado occurred at Thompsontown, Juniata county, Pennsylvania. It moved in a northeasterly direction for a distance of two miles, the width of its path being about 1,200 feet. But little damage was done.

3d.—A tornado occurred at Solebury, Bucks county, Pennsylvania, at 4.30 p. m. Its course was N. 35° E. Several buildings were destroyed or damaged, entailing a loss of \$3,000.

3d.—A tornado occurred north of Lansdale, Montgomery county, Pennsylvania, at about 4 p. m. A number of buildings were destroyed or unroofed.

3d.—At 11.30 a. m. a tornado started at Lederachsville, Montgomery county, Pennsylvania, and passed through Lower Salford, ending near Sumneytown. Its course was N. 10° W.; several barns were destroyed.

3d.—A tornado occurred in Pacopsin township, West Chester county, Pennsylvania, at 5.30 p. m. The tornado-cloud was funnel-shaped and moved in a north-northeasterly direction for a distance of one and one-half miles. Several out-buildings were destroyed.

3d.—A tornado occurred near Milford, Bucks county, Pennsylvania; its path was about twenty feet in width, and the progressive movement about twenty miles per hour. Some out-buildings were destroyed.

3d.—A tornado occurred during the afternoon, at "The Hickory" near Bel Air, Harford county, Maryland. There were two tornado-clouds, both of which were funnel-shaped.

3d.—A tornado occurred in Cecil county, Maryland, at about noon. It passed through Elk Neck and New Leeds, and ended two miles above Cherry Hill. Its course was in a direction N. 12° E., for a distance of fourteen miles, the path being from three hundred to six hundred feet in width. A number of buildings were destroyed.

3d.—A tornado occurred on the Patapsco River, in Maryland, at 5.20 p. m. The tornado-cloud was funnel-shaped and moved in a northeasterly direction.

3d.—A tornado occurred at Buckstown, Dorchester county, Maryland, at 7 p. m. The tornado-cloud was funnel-shaped and moved in a northeasterly direction, its path being about sixty feet in width. A dwelling and barn were destroyed; damage \$1,000.

3d.—At 4.45 p. m. a tornado passed from a point one-half mile southwest of McDonough, New Castle county, Delaware, to a point one mile south of Delaware City. The funnel-shaped tornado-cloud moved in a direction northeast by north for a distance of nine miles at an average velocity of twenty miles per hour. Two dwellings and a number of out-buildings were destroyed. The damage is estimated at \$5,000.

3d.—A tornado occurred at Metomen, Fond du Lac county, Wisconsin, at 2.35 p. m. Its path was in a southeasterly direction for a distance of ten miles, and was about two hundred and fifty feet wide. Some out-buildings were destroyed.

5th.—A tornado occurred near Arrington, Atchison county, Kansas, at 1.25 p. m. Its course was in a direction east by north for a distance of one mile.

12th.—At 4.48 p. m. a tornado occurred at Norwood, Saint Lawrence county, New York, and moved in a direction E. 20° N. for a distance of fifteen miles, its path being one-half mile in width. The shortest time in passing a given point was from three to five minutes. Two persons were killed, ten injured, and property valued at \$150,000, destroyed.

## NAVIGATION.

### STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest stages for August, 1885, with the dates of occurrence, and the monthly ranges:

*Heights of rivers above low-water mark, August, 1885.*

[Expressed in feet and tenths]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29 9	1	15 3	31	3 9	11 4
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22 0	16	8 2	28	4 3	3 9
Little Rock, Arkansas.....	23 0	20	8 2	31	5 1	3 1
<i>Missouri River:</i>						
Yankton, Dakota.....	24 0	2	17 9	27, 28	15 5	2 4
Omaha, Nebraska.....	18 0	2	10 7	31	7 4	3 3
Leavenworth, Kansas.....	20 0	1	13 4	23, 24	9 5	3 9
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14 5	1, 2	4 3	23 to 30	3 0	1 3
La Crosse, Wisconsin.....	24 0	1	8 6	31	4 5	4 1
Dubuque, Iowa.....	16 0	4, 5	9 6	31	5 7	3 9
Davenport, Iowa.....	15 0	4, 26	8 2	17 to 22	5 0	3 2
Keokuk, Iowa.....	14 0	29	12 0	21	5 5	3 5
Saint Louis, Missouri.....	32 0	15	19 6	26	12 9	6 7
Calvo, Illinois.....	40 0	17	20 5	29	14 3	6 2
Memphis, Tennessee.....	34 0	19, 20	13 3	31	9 2	4 6
Vicksburg, Mississippi.....	41 0	1	13 5	31	13 2	5 3
New Orleans, Louisiana*.....	—3 0	1	—6 5	16, 17	—11 7	2 9
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22 0	26	12 3	2	1 4	10 9
Cincinnati, Ohio.....	50 0	31	19 7	1	7 5	12 2
Louisville, Kentucky.....	25 0	9	7 0	2	4 3	3 3
<i>Chamberland River:</i>						
Nashville, Tennessee.....	40 0	20	6 0	31	1 1	4 9
<i>Tennessee River:</i>						
Chattanooga, Tennessee.....	33 0	16	4 4	30, 31	1 3	3 1
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29 0	25	12 3	2	1 4	10 9
<i>Savannah River:</i>						
Augusta, Georgia.....	32 0	31	10 0	27, 29	5 0	5 0
<i>Mobile River:</i>						
Mobile, Alabama.....	9, 11, 30	16 8	20	15 0	1 8	
<i>Sacramento River:</i>						
Red Bluff, California.....	1 to 20	0 5	21 to 31	0 4	0 1	
Sacramento, California.....	1 to 11	7 8	26 to 31	7 3	0 5	
<i>Willamette River:</i>						
Portland, Oregon.....	1	6 0	20	3 6	2 4	
<i>Colorado River:</i>						
Yuma, Arizona.....						

\* Below high-water mark of 1874 and 1883.

The observer at Chattanooga reports that navigation in the lower Tennessee River was suspended on the 25th, on account of low water.

### HIGH TIDES.

New London, Connecticut, 3d: very high tide, flooding cellars and low grounds.

Cedar Keys, Florida, 9th to 12th.

Eastport, Maine, 14th, 15th, 16th.

New York City, 9th.

Portsmouth, North Carolina, 9th.

New River Inlet, North Carolina, 10th, 11th.  
Fort Macon, North Carolina, 7th.

#### LOW TIDE.

Indianola, Texas, 1st.

#### FLOODS.

The floods of August, 1885, were of local character and were confined to the smaller rivers and streams, as will be seen from the following reports:

Chicago, Illinois: very heavy rain fell throughout the 2d; from 7 a. m. until 11 p. m. 5.49 inches of rain fell. A large number of cellars and basements were flooded. Heavy losses were sustained by merchants having goods stored in cellars.

Fallston, Harford county, Maryland: the rainfall on the 3d (5.96 inches) is the largest amount for one day that has been recorded since September, 1870. The Little Gunpowder River rose to a height seven feet higher than any previous flood mark. Bridges, dams, etc., along the course of the river were swept away.

Baltimore, Maryland: the very heavy rainfall on the 3d, with an unusually high tide, caused Jones Falls to overflow portions of neighboring streets. The rainfall amounted to 3.35 inches. Much damage was done to crops in the adjacent counties.

Hartford, Connecticut: during the night of the 3-4th occurred one of the heaviest rain storms ever experienced here. The rainfall, as collected by different gauges in this vicinity, ranged from about 3.50 to 5.50 inches. Several washouts occurred on the Connecticut Valley railroad, causing delay of trains. The Connecticut River rose more than four feet.

Whitehall, Washington county, New York: the very heavy rains on the 12th and 13th caused a large amount of damage to farm property in this county. A washout occurred near Fairhaven, and another about two miles north of Whitehall.

Bellows Falls, Windham county, Vermont: one of the heaviest rain storms of the season occurred here during the night of the 13-14th. The Connecticut River rose rapidly; a section of a boom protecting the Fall Mountain dam gave way.

White River Junction, Windsor county, Vermont: the heaviest rain storm that has occurred here since 1869 prevailed on the 13th and during the night of the 13-14th. The highways were badly washed and many bridges were swept away. The damage at this place is estimated at \$2,000.

Concord, New Hampshire: the very heavy rainfall on the 13th and 14th caused the undermining of several buildings and the washing away of roads, bridges, etc., throughout the Pemigewasset Valley, and the crops in many localities were entirely ruined. The Pemigewasset River rose thirteen feet in ten hours, and the Contocook River rose five feet in eight hours. Reports indicate that the area of excessive rainfall extended diagonally across the state from northwest to southeast. But little rain fell at Concord and in the northern part of the state.

Plymouth, New Hampshire, 14th: during the past week very heavy rains have fallen in this part of the state, causing a destructive freshet. In but two instances during the past twenty years, viz., in the autumn of 1869, and in December, 1881, has the Pemigewasset River reached a higher stage than during this freshet. A large amount of damage was done to crops, bridges, and other property.

Davenport, Iowa: the remarkably heavy rainfall on the 23d and 24th caused much damage in this city and vicinity, more than six inches of rain having fallen on those dates. Traffic on the various railroads running into this city was interrupted on account of washouts. All streams in the surrounding country were much swollen, and many bridges were washed away.

Cedar Rapids, Linn county, Iowa: on the 23d and 24th a very heavy rain storm prevailed, more than three and one-half inches of rain having fallen. Washouts occurred on the railroads in this vicinity, and numerous bridges were washed away.

Savannah, Georgia: very heavy rains fell on the 31st, from

early morning until 2 p. m. During that time 4.34 inches of rain fell, which resulted in considerable damage to railroads, bridges, etc., in this vicinity.

#### VERIFICATIONS.

##### INDICATIONS.

The detailed comparison of the tri-daily indications for August, 1885, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 86.31 per cent. The percentages for the four elements are: Weather, 83.15; direction of the wind, 90.71; temperature, 85.01; barometer, 87.32 per cent. By geographical districts, they are: For New England, 82.49; middle Atlantic states, 84.91; south Atlantic states, 88.08; eastern Gulf states, 88.39; western Gulf states, 81.99; lower lake region, 84.01; upper lake region, 86.46; Ohio Valley and Tennessee, 86.07; upper Mississippi valley, 86.45; Missouri Valley, 84.07; north Pacific coast region, 91.37; middle Pacific coast region, 91.23; south Pacific coast region, 93.73. There were 3,374 predictions made, of which number, seventy-eight or 2.31 per cent., are considered to have entirely failed; one hundred and two, or 3.02 per cent., were one-fourth verified; three hundred and thirty, or 9.78 per cent., were one-half verified; five hundred and sixty-nine, or 16.87 per cent., were three-fourths verified; 2,295, or 68.02 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The percentages of verifications of special predictions for certain localities are, as follows:

Chambersburg and York, Pennsylvania, 78.23; Richmond, Virginia, 80.65; Meadville, Pennsylvania, 74.60; Oil City, Pennsylvania, 77.82; Columbus, Ohio, 61.70; Bucyrus and northern Ohio, 71.77; Albany, New York, 76.21; Cincinnati, Ohio, 76.21; Buffalo, New York, 76.61; Indianapolis, Indiana, 74.60; Chicago, Illinois, 82.66; Saint Louis, Missouri, 76.21; Cairo, Illinois, 79.10; Boston, Massachusetts, and New Haven, Connecticut, 69.35; Louisville, Kentucky, 71.77; Detroit, Michigan, 80.65; Kansas, Indian Territory and western Missouri, 75.81; central Illinois and western Indiana, 78.63; north-western Ohio and eastern Indiana, 75.40; Toledo, Ohio, 73.79; Milwaukee, Wisconsin, 81.85; Alabama, 82.67; Jacksonville, Florida, 80.24; Omaha, Nebraska (twenty-five days), 75.50; Arkansas (twenty-five days), 75.00; Georgia (twenty-five days), 84.50; Tennessee (twenty-five days), 76.00; Dallas, Texas, twenty-five days, 86.00; Rochester and Oswego, New York, 79.00; Portland, Maine, 63.71; New York City and Philadelphia, Pennsylvania, 77.82; Colorado, 80.66; District of Columbia and Baltimore, Maryland, 68.15; Memphis, Tennessee, beginning on the 20th, 61.46; Shreveport, Louisiana, beginning on the 20th, 86.46; Cumberland, Maryland, beginning on the 26th, 83.33; Hagerstown, Maryland, beginning on the 26th, 83.33; Wheeling, West Virginia, beginning on the 26th, 91.67; Lawrenceburg, Indiana, beginning on the 26th, 75.00; Blanchester, Ohio, beginning on the 27th, 60.00; Portsmouth, Ohio, one day (31st), 50.00.

##### CAUTIONARY SIGNALS.

During August, 1885, seventy-nine cautionary signals were ordered. Of these, fifty-four, or 68.35 per cent., were justified by winds of twenty-five miles or more per hour, at or within one hundred miles of the station. Forty-one cautionary off-shore signals were ordered, of which number, twenty-two, or 53.66 per cent., were fully justified both as to direction, and velocity; thirty-two, or 78.05 per cent., were justified as to direction, and twenty-five, or 60.98 per cent., were justified as to velocity. One hundred and twenty signals of all kinds were ordered, seventy-six, or 63.33 per cent., being fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Of the above cautionary off-shore signals, twenty-six were changed from cautionary signals. Four signals were ordered late. In sixty-four cases winds of twenty-five miles or more per hour were reported for which no signals were ordered.